

Application No. 09/508,934
Amendment dated August 21, 2003
Reply to Office Action of May 21, 2003

Remarks

This amendment is responsive to the Office Action mailed May 21, 2003 in connection with the above-identified patent application. In that Action, independent claim 5 was withdrawn from further consideration under 37 C.F.R. § 1.142(b). Claim 1 was objected to for an informality identified by the Examiner. Claims 1 and 11 were rejected Under 35 U.S.C. § 102(b) as being anticipated by European Patent Publication EP 0 469 426 ("EP '426"). Claims 18 and 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by PCT Publication WO 96/22629 ("WO '629"). Claims 12-17 were indicated as containing allowable subject matter and were objected to as being dependent upon a rejected base claim. Lastly, claims 20 and 21 were allowed.

THE NON-ART REJECTIONS

Referring again to the Office Action and to repeat, claim 1 was objected to because, according to the Examiner, it contained an informality. More particularly, the Examiner took the position that the phrase "the other" in line 14 should be replaced with the term --another--.

Applicants have amended independent claim 1 above to address the Examiner's concerns. It is respectfully submitted that the claim is now in proper form.

THE ART REJECTIONS

With reference yet once again to the Office Action, claims 1 and 11 were rejected as being anticipated by EP '426. The Examiner took the position that each of the method steps recited in those claims were found in the EP '426 document. Further in the Action, claims 18 and 19 were

rejected as being anticipated by WO '629. The Examiner took the position that the WO '629 publication discloses the final structure of four groups of conductors on stator teeth.

The Present Application:

For purposes of review, the present application is directed to improvements in stator constructions and methods of winding a stator to realize an improved efficiency thereof. As described in the specification, the invention proceeds from the recognition that as a result of dividing winding procedures for coupled coils of opposite phases into partial winding steps, significant simplification is realized in the manufacturing method and improved efficiencies result.

In comparison with stators produced according known methods, the methods and apparatus of the present invention to improve magnetic coupling of the coils of the respectively opposite phases. As outlined in the specification, this can be explained in part in that with simultaneous winding of all wires of two coils according to the prior art practice, and allocation of the wire ends after the winding procedure, there was, more or less, random allocation and positioning of the individual wires within one coil. In contrast, in accordance with the present application, by separation of the windings into partial winding steps, closer proximity of the individual wires of the coils is achieved, at least on balance, for more uniform distribution resulting in improved results.

In accordance with the preferred embodiment of the invention, by winding only two wires respectively (one per

coil) the two wires are placed close to each other over the entire length of the coil.

As a further benefit, the improve coupling and close proximity of the wire pairs results in an improved ability of replicating electrical properties of the stator. More particularly, stators wound according to the preferred method have consistent properties overall.

Claims 1 and 11 are Patentable Over EP '426:

As noted above, the Examiner took the position that claims 1 and 11 were anticipated by EP '426.

Column 1, at lines 11-27 of the EP '426 document describes that modern stators often have more than one coil portion wound onto each stator pole. In column 5, at lines 7-33, it is described that each of the two coils 30 is comprised of two portions, each portion having a start and a finished lead. However, the EP '426 document fails to disclose that the two portions of each coil 30 are wound onto the stator teeth simultaneously and in partial winding steps. In fact, it is to be assumed that the two coil portions of each coil 30 are wound onto the corresponding stator tooth one after the other in a sequential fashion. Thus, there are no partial winding steps with an even number of $2n$ conductors. The leads 31, 32, 33, and 34 are temporarily anchored in auxiliary grippers 51-54 after having wound the corresponding coil portions onto the stator core.

It is respectfully submitted that the EP '426 document contains no further hint or discussions which would lead one of ordinary skill in the art to develop a method according to the invention of simultaneously winding coil

pairs onto stator teeth and allocating the conductor to respective coils between partial winding steps. Independent claims 1 and 11 have been amended above to reinforce the limitation that the coil pairs are simultaneously wound onto the stator teeth. This limitation was previously presented in the claims but was perhaps not clear to the Examiner. The amendments above are purposes of only clarifying the claim to facilitate further prosecution.

Turning now to independent claim 1, a method is recited for winding a stator of a brushless direct current motor including the steps of simultaneously winding each of the stator teeth in several partial winding steps, with an even number of $2n$ conductors allocating a first set of n conductors of the $2n$ conductors to a first coil and allocating the other set of n conductors of the $2n$ conductors to the other coil, and repeating this step until the predetermined number of conductors per coil has been reached.

It is respectfully submitted that independent claim 1 includes limitations not taught or suggested in the EP '426 document such as and including the step of simultaneously winding stator teeth in several partial steps and repeating the partial winding steps until a predetermined number of conductors has been reached.

Independent claim 11 includes limitations not taught, suggested, or fairly disclosed in the EP '426 document. A coil winding method is described including the steps of a first partial coil winding step simultaneously winding to n conductors together onto a first plurality of stator teeth, selecting first and second groups of conductors and assigning the first and second group of

conductors to first and second coils of a set of magnetically coupled coil pairs, and repeating these steps until a predetermined number of conductors are wound onto a plurality of stator teeth to form a first magnetically coupled pair of a set of magnetically coupled coil pairs.

Again, it is respectfully submitted that the EP '426 document does not teach, suggest, or fairly disclose a coil winding method including a series of partial coil winding steps which are repeated until a predetermined number of coils are wound onto a plurality of stator teeth. This limitation is clearly set forth in independent claim 1 of the present application.

For at least the above reasons, it is respectfully submitted that independent claims 1 and 11 and claims 23-28 dependent therefrom are patentably distinct and unobvious over the reference of record.

Claims 18 and 19 are Patentable Over WO '629:

As noted above, the Examiner took the position that claims 18 and 19 were anticipated by WO '629. The Examiner noted in the Action that WO '629 discloses the final structure of four groups of conductors on stator teeth.

It is respectfully submitted that the WO '629 document only discloses that the magnetic coupling of the coils of the four-face DC motor is improved when the corresponding coupled coils are wound on the stator core simultaneously. However, the WO '629 document does not teach that the coils can be wound ~~on~~ the corresponding stator teeth in more than a single step, each winding step including winding 2n conductor simultaneously and selecting

a first and a second group of n conductors and assigning each group to a first or second coil.

X (It is respectfully submitted that the Examiner cannot ignore the steps of "selecting and repeating" in claims 18 and 19 as the steps have a decisive influence on the structure of the resultant coil wound in this manner. The novel approach of dividing the winding process into several steps has the effect that in each step a smaller number of conductors are wound on the stator core. Thus, when dividing the $2n$ conductors into two groups and allocating each group to a first and second coil, the magnetic coupling between the two coils is improved as compared to the method of winding all conductors from the two coils in a single step.

Applicants respectfully submit that independent claims 18 and 19 as amended above are patentably distinct and unobvious over the WO '629 reference. More particularly, independent claim 18 recites a stator having teeth and a set of conductors wound onto the teeth. The conductors are wound by performing a series of partial winding procedures. The conductor pairs are essentially "layered" onto conductors wound in previous partial winding steps. This construction, as noted above, results in improved efficiencies in the stator properties and in improved consistency between individual stators.

It is respectfully submitted that the WO '629 patent does not teach, suggest, or fairly disclose a stator having conductors wound thereon in partial winding steps.

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Conclusion

In view of the above amendments, comments, and arguments presented, applicants respectfully submit that all pending claims are patentably distinct and unobvious over the references of record.

Allowance of all claims and early notice to that effect is respectfully requested.

Respectfully submitted,

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